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(56) Documents cited

**GB 1585433 GB 1431668 GB 1068082**  
**GB 0604556 WO A1 82/03574 US 3907193**

(58) Field of search

**A4B**  
**B3A**  
**B3E**  
**B8P**  
**Selected US specifications from IPC sub-class**  
**B21D**

(54) Sheet metal articles

(57) A sheet metal article is formed from one or more sheet metal panels (2), each having a channel (1) pressed into one surface of the panel (2) along a bend line. The panel (2) is bent along the bend line by grasping the panel (2) on both sides of the line and manually folding the panel. To increase rigidity, the channel (1) is formed such that the rims of the channel walls (3, 4) abut each other when the panel (1) is folded. A gently radiused bend in a panel can be achieved by pressing a plurality of parallel channels in a panel in a band of width  $1.57R$  where  $R$  is the required bend radius. Panels formed with channels in this way are suitable as components in a flat-pack kit for assembling a box-like article.

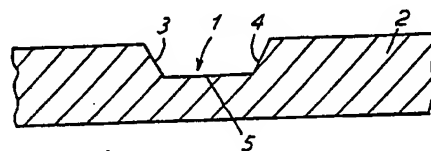


FIG. 1

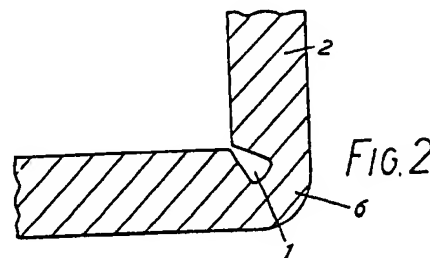
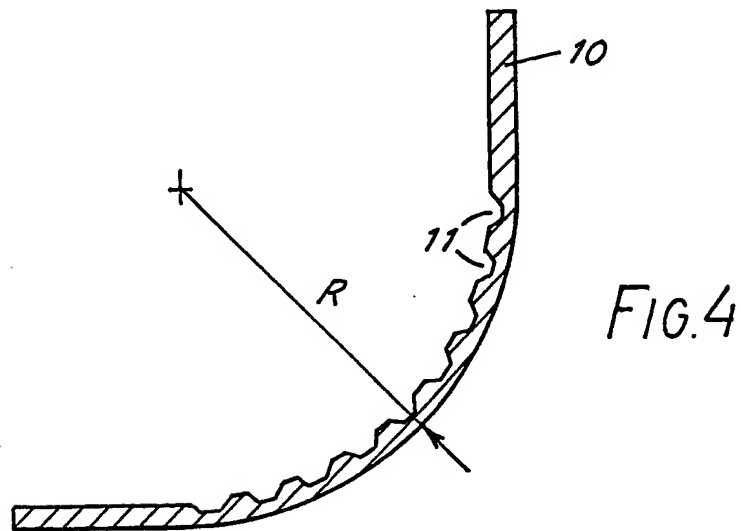
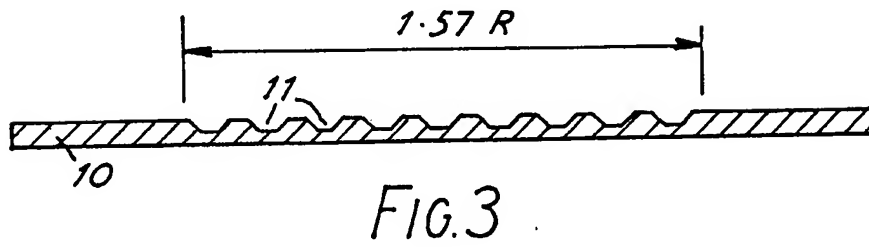
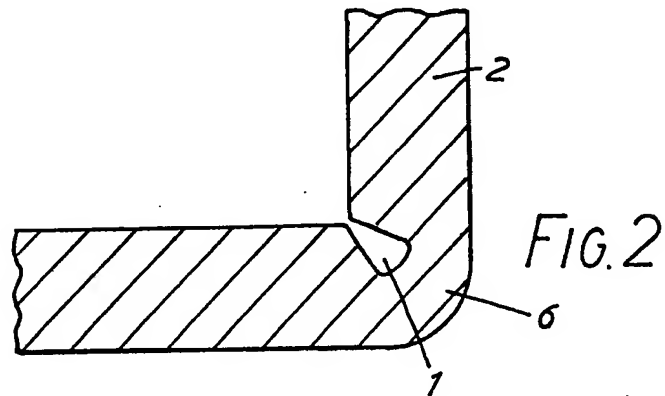
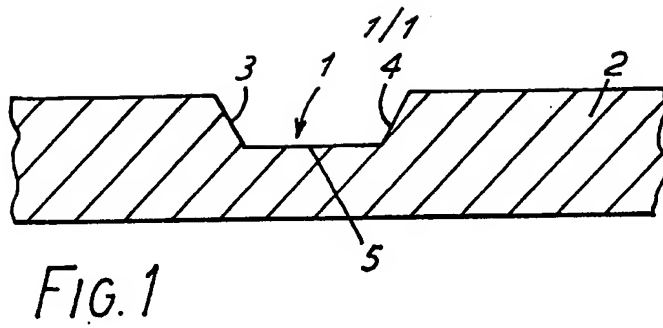


FIG. 2

The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.



SHEET METAL ARTICLES

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This invention relates to sheet metal articles which are manufactured by bending sheet metal panels. The invention is concerned particularly, but not exclusively, with sheet metal cabinets and other box-like articles.

It is well known to manufacture metal articles by bending appropriately shaped sheet metal panels, using mechanical presses with dies and formers shaped to form the required bends. This process is both machine and labour intensive, requiring costly manufacturing facilities and the articles have to be stored and transported in the completed state. In addition, due to the degree of mechanical handling by the machinery which is required to produce the articles, it is necessary to apply paint and finishing treatments to the completed article. Thus, storage and transport costs are high due to the bulky nature of the completed articles and painting and finishing costs are increased as the shape of the articles becomes more complex.

It is known to market sheet metal cabinets as "flat packs" comprising panels which have to be assembled with fastening devices. This is a relatively expensive solution. It is also known to provide a panel which can be bent by hand along a bend line defined by a row of holes or slots through the metal. This gives a somewhat unsightly result.

The object of the present invention is to provide an improved method of forming a sheet metal article and an improved flat-pack cabinet kit which enable a good product to be produced cheaply.

According to the present invention there is provided a method of forming a sheet metal article wherein a sheet metal panel is uniformly thinned along a bend line sufficiently to allow the panel to be bent along the bend line by grasping the panel on either side of the bend line and manually folding the grasped parts of the panel towards each other. Although the degree of thinning must be sufficient to make the manual bending possible, it is obvious that

over-thinning should be avoided in order that the article shall not be unduly weak at the bend.

The thinning may be effected by pressing or rolling a channel into one or both faces of the panel. One possibility, when a sharp bend is required, is to form a channel in only what will be the inside of the bend, with a cross-section such that the two rims of the channel will at least approximately abut when the panel has been bent to the shape it assumes in the finished article. If a gently radiused bend is required, a plurality of parallel channels can be formed in a band of the panel. If the bend is to be a  $90^\circ$  bend, the band should have a width approximately equal to  $R \cdot \pi/2$ , i.e.  $1.57R$ , where  $R$  is the required bend radius.

A kit for a cabinet can comprise one or more of the panels, each formed with one or more bend lines so disposed that the panel(s) can be bent up into the walls of the cabinet. Any conventional fastening devices or means can be used to complete the assembly by connecting together edges brought together by the bending and by connecting together edges of different bent-up panels. Such edges may be provided with pre-formed flanges.

According to the invention in a second aspect, there is provided a flat-pack kit for a box-like article comprising a plurality of sheet metal panels, each of which is thinned along at least one bend line to enable the panel to be bent manually along that line, the panels and their bend lines being so shaped and disposed that the panels, when bent up, together form the walls of the article.

The panels of the kit are preferably pre-painted or otherwise pre-finished so that the assembled article does not have to be painted or finished. The flat pack kits can be warehoused and transported as such. The retailer may effect bending and assembly and sell only complete articles or flat-pack kits may be sold to the customer for customer assembly.

Embodiments of the present invention will now be described, by way

of example, with reference to the accompanying drawings in which;

Fig 1 is a sectional view of a metal panel through a bend line,

Fig 2 is a sectional view of the metal panel of Fig 1 after bending,

Fig 3 is a sectional view of a panel with a plurality of bend lines,  
and

Fig 4 shows the panel of Fig 3 after bending.

The metal panel 2 of Fig 1 is formed from sheet steel as a flat or substantially flat panel shaped by conventional metal working methods to correspond to the completed article after bending of the panel. A channel 1 is pressed into one surface of the panel along a bend line. The panel thus thinned along the bend line can be manually bent very quickly and with great accuracy. The pressing hardens the thinned metal which can become slightly brittle, as well as being weakened by the thinning. However adequate tensile strength to withstand the bending is readily achieved and the article will have adequate strength along the bend because of the stiffening effect of a bend. Whilst pressing is the most efficient and preferred method of forming the channel, other methods of forming a channel could be employed, for example milling or cutting.

The channel 1 shown in Figure 1 is pressed to be trapezoidal in cross-section and sufficiently deep to enable the blank to be accurately bent through 90 degrees. The cross-section of the channel can be adapted to the thickness of the metal and the required angle of the bend. The base 5 is made wide enough to limit the straining of the metal and prevent the metal cracking in the outer regions 6 of the bend.

The channel has side walls 3 and 4 and a base 5. The channel is shown on Figure 2 after the panel has been bent. The rims of the channel walls 3 and 4 are brought to abut each, which increases the rigidity and strength of the completed article.

The thickness of the panel will depend upon the completed article but is typically in the range 0.6mm to 1.2mm. The bend lines can be thinned to around 0.5 mm to make rapid and accurate bending by hand possible.

A metal drawer may comprise a flat rectangular base and two sides perpendicular to the base. A rectangular panel is formed from 0.8mm mild steel and two channels each with a cross-section as illustrated in Fig. 1 are pressed along the bend lines of the drawer, reducing the metal thickness to 0.44mm. The drawer can be formed by bending the two sides upwards by hand and attaching a front and back to the bent up panel.

Fig 3 illustrates a panel 10 formed with a plurality of parallel channels 11 in a band of width  $1.57R$ . When the panel is bent through  $90^\circ$  by hand, the channelled band forms a curve of radius  $R$ . This technique is useful when the radius  $R$  of the bend is to be large, say 1cm, 2cm or even more. The larger  $R$ , the greater the number of channels 11.

CLAIMS

1. A method of forming a sheet metal article wherein a sheet metal panel is uniformly thinned along a bend line sufficiently to allow the panel to be bent along the bend line by grasping the panel on either side of the bend line and manually folding the grasped parts of the panel towards each other.
2. A method according to claim 1, wherein the panel is uniformly thinned by forming a channel in one face of the panel.
3. A method according to claim 2, wherein the channel is formed by pressing.
4. A method according to claim 2, wherein the channel is formed by rolling.
5. A method according to any of claims 2 to 4, wherein the channel is formed in a face of the panel so as to be on the inside of the bend in the sheet metal article.
6. A method according to claim 5, wherein the channel has a cross-section such that the two rims of the channel will at least approximately abut when the panel has been bent to the shape it assumes in the sheet metal article.
7. A method according to any of claims 2 to 6, wherein a plurality of parallel channels are formed in a band of the panel.
8. A method according to claim 7, wherein the channels are uniformly spaced apart so that the bend assumed by the panel in the sheet metal article is uniformly curved.
9. A flat-pack kit for a box-like article comprising a plurality of sheet metal panels, each of which is thinned along at least one bend line to enable the panel to be bent manually along that line, the panels and their bend lines being so

shaped and disposed that the panels, when bent up, together form the walls of the article.

10. A kit according to claim 9, wherein each panel is thinned by having a channel formed in one face of the panel along at least one bend line.
11. A kit according to claim 10, wherein the channel is formed by pressing.
12. A kit according to claim 10, wherein the channel is formed by rolling.
13. A kit according to any of claims 9 to 12, wherein the channel is so disposed that it is on the inside of the bend when the panel is bent up.
14. A kit according to claim 13, wherein the channel has a cross-section such that the two rims of the channel at least approximately abut when the panel is bent up.
15. A kit according to any of claims 9 to 14, wherein at least one panel has a plurality of parallel channels formed in a band of the panel.
16. A kit according to claim 15, wherein the channels are uniformly spaced apart such that when the panel is bent up, the bend is uniformly curved.
17. A method substantially as hereinbefore described with reference to Figures 1 and 2.
18. A method substantially as hereinbefore described with reference to Figures 3 and 4.